

MOONEY AIRCRAFT CORPORATION

**LOUIS SCHREINER FIELD
KERRVILLE, TEXAS 78028**

AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR

MOONEY M20J, M20K, M20M, M20R, M20S

WITH

KLN 89B GPS NAVIGATION SYSTEM

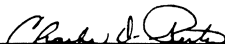
MODEL NO. _____

REG. NO. _____

SER. NO. _____

This supplement must be attached to the FAA approved Airplane Flight Manual when King KLN-89B GPS Navigation System has been installed in accordance with Mooney drawing number 810434. The information contained herein supplements or supercedes the information of the basic Airplane Flight Manual only in those areas listed herein. For Limitations, Normal Procedures, Abnormal/Emergency Procedures and Performance Data not contained within this Supplement, consult the basic Airplane Flight Manual.

FAA APPROVED _____



for Michele M. Owsley - Manager
AIRCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FORT WORTH, TEXAS 76193-0150

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MOONEY AIRCRAFT CORPORATION				
LOUIS SCHREINER FIELD KERRVILLE, TEXAS 78028				
LOG OF REVISIONS				
Revision Number	Revision Pages	Description of Revisions	FAA Approved	Date
B	ALL PAGES	ADDED M20S APPLICATION TO ALL PAGES.	<i>Charles D. Smith</i>	2/7/99

The revised portions of affected pages are indicated by vertical black lines in the margin.

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SECTION I - GENERAL

The KLN 89B GPS panel mounted unit contains the GPS sensor, the navigation computer, a CRT display, and all controls required to operate the unit. It also houses the data base card which plugs directly into the front of the unit.

The data base card is an electronic memory containing information on airports, nav aids, intersections, SID's, STAR's, instrument approaches, special use airspace, and other items of value to the pilot.

Every 28 days, Bendix/King receives new data base information from Jeppesen Sanderson for the North American data base region. This information is processed and downloaded onto the data base cards. Bendix/King makes these data base card updates available to KLN 89B GPS users.

Provided the KLN 89B GPS navigation system is receiving adequate usable signals, it has been demonstrated capable of and has been shown to meet the accuracy specifications of:

VFR/IFR en route oceanic and remote, en route domestic, terminal, and instrument approach (GPS, Loran-C, VOR, VOR-DME, TACAN, NDB, NDB-DME, RNAV) operation within the U.S. National Airspace System, North Atlantic Minimum Navigation Performance Specifications (MNPS) Airspace and latitudes bounded by 74 North and 60 South using the WGS-84 (or NAD 83) coordinate reference datum in accordance with the criteria of AC 20-138, AC 91-49, and AC 120-33. Navigation data is based upon use of only the global positioning system (GPS) operated by the United States.

NOTE

Aircraft using GPS for oceanic IFR operations may use the KLN 89B to replace one of the other approved means of long-range navigation. A single KLN 89B GPS installation may also be used on short oceanic routes which require only one means of long-range navigation.

NOTE

FAA approval of the KLN 89B does not necessarily constitute approval for use in foreign airspace.

NOTE

When the KLN 89B contains receiver software RCVR 01621-0001 (or higher dash number), as verified on the OTH 6 page, the unit is qualified for BRNAV operation in the European region in accordance with the criteria of AC 90-96. (Reference ICAO Doc 7030 Regional Supplementary Procedures, JAA Technical Guidance Leaflet AMJ20X2 and Eurocontrol RNAV Standard Doc 003-93 Area Navigation Equipment Operational Requirements and Functional Requirements (RNAV).)

SECTION II - LIMITATIONS

- A. The KLN 89B GPS Pilot's Guide, P/N 006-08786-0000, dated May, 1995 (or later applicable revision) must be immediately available to the flight crew whenever navigation is predicated on the use of the system. The Operational Revision Status (ORS) of the Pilot's Guide must match the ORS level annunciated on the Self Test page.
- B. IFR Navigation is restricted as follows:
 1. The system must utilize ORS level 01 or later FAA approved revision.
 2. The data on the self test page must be verified prior to use.
 3. IFR en route and terminal navigation is prohibited unless the pilot verifies the currency of the data base or verifies each selected waypoint for accuracy by reference to current approved data.
 4. Instrument approaches must be accomplished in accordance with approved instrument approach procedures that are retrieved from the KLN 89B data base. The KLN 89B data base must incorporate the current update cycle.
 - a. The KLN 89B Quick Reference, P/N 006-08787-0000, dated 5/95 (or later applicable revision) must be immediately available to the flight crew during instrument approach operations.
 - b. Instrument approaches must be conducted in the approach mode and RAIM must be available at the Final Approach Fix.

SECTION II - LIMITATIONS (con't.)

- c. APR ACTV mode must be annunciated at the Final Approach Fix.
 - d. Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, and MLS approaches are not authorized.
 - e. When an alternate airport is required by the applicable operating rules, it must be served by an approach based on other than GPS or Loran-C navigation.
 - f. The KLN 89B can only be used for approach guidance if the reference coordinate datum system for the instrument approach is WGS-84 or NAD-83. (All approaches in the KLN 89B data base use the WGS-84 or the NAD-83 geodetic datums.)
5. The aircraft must have other approved navigation equipment appropriate to the route of flight installed and operational.
6. For BRNAV operations in the European region:
- a. With 23 (24 if the altitude input to the KLN 89B is not available) or more satellites projected to be operational for the flight, the aircraft can depart without further action.
 - b. With 22 (23 if the altitude input to the KLN 89B is not available) or fewer satellites projected to be operational for the flight, the availability of the GPS integrity (RAIM) should be confirmed for the intended flight (route and time). This should be obtained from a prediction program run outside of the aircraft. The prediction program must comply with the criteria of Appendix 1 of AC90-96. In the event of a predicted continuous loss of RAIM of more than 5 minutes for any part of the intended flight, the flight should be delayed, cancelled, or rerouted on a track where RAIM requirements can be met.

NOTE

AlliedSignal's Preflight, Version 2.0 or later computer based prediction program may be used for the RAIM prediction. Alternate methods should be submitted for approval in accordance with Advisory Circular AC90-96.

7. Placards Required.

NONE

SECTION III - EMERGENCY PROCEDURES

- A. If the KLN 89B GPS information is not available or invalid, utilize remaining operational navigation equipment as required.
- B. If a "RAIM NOT AVAILABLE" message is displayed while conducting an instrument approach, terminate the approach. Execute a missed approach if required.
- C. If a "RAIM NOT AVAILABLE" message is displayed in the en route or terminal phase of flight, continue to navigate using the KLN 89B or revert to an alternate means of navigation appropriate to the route and phase of flight. When continuing to use GPS navigation, position must be verified every 15 minutes using another IFR approved navigation system.
- D. Refer to the KLN 89B Pilot's Guide, Appendices B and C, for appropriate pilot actions to be accomplished in response to annunciated messages.

SECTION IV - NORMAL PROCEDURES

WARNING

Familiarity with the en route operation of the KLN 89B does not constitute proficiency in approach operations. Do not attempt approach operations in IMC prior to attaining proficiency in the use of the KLN 89B.

A. OPERATION

Normal operating procedures are outlined in the KLN 89B GPS Pilot's Guide, P/N 006-08786-0000, dated May 1995, (or later applicable revision). A KLN 89B Quick Reference, P/N 006-08787-0000 dated 5/95 (or later applicable revision) containing an approach sequence, operating tips and approach related messages is intended for cockpit use by the KLN 89B familiar pilot when conducting instrument approaches.

SECTION IV - NORMAL PROCEDURES (con't.)

WARNING

To prevent the possibility of turn anticipation causing potentially misleading navigation when the aircraft is not on course:

- Verify the HSI course and D-BAR presentation is proper prior to takeoff.
- Do not switch from OBS to LEG with greater than 1 nm cross track error (XTK).
- If misleading data is suspected, a Direct-To operation to your desired waypoint will clear any previous OBS course, and cancel turn anticipation.

NOTES

- After the above Direct-To operation, further reorientation to the nearest leg of the active flight plan may be accomplished by pressing:




- Refer to the Pilot's Guide section 4.2.2 for an explanation of turn anticipation, and Appendix A - Navigation Terms for the definition of cross track error (XTK).

B. SYSTEM ANNUNCIATORS/SWITCHES/CONTROLS


1. HSI NAV presentation (NAV/GPS) switch annunciator - May be used to select data for presentation on the pilot's HSI; either NAV data from the number one navigation receiver or GPS data from the KLN 89B GPS. Presentation on the HSI is also required for autopilot coupling.
2. Message (MSG) annunciator - Will flash to alert the pilot of a situation that requires attention. Press the MSG button on the KLN 89B GPS to view the message. (Appendix B of the KLN 89B Pilot's Guide contains a list of all of the message page messages and their meanings).
3. Waypoint (WPT) annunciator - Prior to reaching a waypoint in the active flight plan, the KLN 89B GPS will provide navigation along a curved path segment to ensure a smooth transition between two adjacent legs in the flight plan. This feature is called turn anticipation. Approximately 20 seconds prior to the beginning of turn anticipation the WPT annunciator will flash, going solid upon initialization of the turn, and extinguishing upon turn completion.

WARNING

Turn anticipation is automatically disabled for FAF waypoints and those used exclusively in SID/STARS where overflight is required. For waypoints shared between SID/STARS and published en route segments (requiring overflight in the SID/STARS), proper selection on the presented waypoint page is necessary to provide adequate route protection on the SID/STARS.

4. HSI course control knob -  Provides analog course input to the KLN 89B in OBS when the NAV/GPS switch/annunciator is in GPS. When the NAV/GPS switch annunciator is in NAV, GPS course selection in OBS mode is digital through the use of the controls and display at the KLN 89B. The HSI course control knob must also be set to provide proper course datum to the autopilot if coupled to the KLN 89B in LEG or OBS.

NOTE

Manual HSI course centering in OBS using the control knob can be difficult, especially at long distances. Centering the dbar can best be accomplished by pressing  and then manually setting the HSI pointer to the course value prescribed in the KLN 89B displayed message.

5. GPS approach (GPS APR ARM/ACTV) switch/annunciator - Used to a) manually select or deselect approach ARM (or deselect approach ACTV) and b) announce the stage of approach operation either armed (ARM) or activated (ACTV). Sequential button pushes if in ACTV would first result in approach ARM and then approach arm canceled. Subsequent button pushes will cycle between the armed state (if an approach is in the flight plan) and approach arm canceled. Approach ACTV cannot be selected manually.
6. RMI NAV presentation switch - May be used to select data for presentation on the RMI; either NAV 1 data from the number one navigation receiver, NAV 2 data from the number two navigation receiver or GPS data from the KLN 89B GPS.

SECTION IV - NORMAL PROCEDURES (con't.)

C. PILOT'S DISPLAY

Left/right steering information is presented on the pilot's HSI as a function of the NAV/GPS switch position.

D. AUTOPILOT COUPLED OPERATION

The KLN 89B may be coupled to the autopilot by first selecting GPS on the NAV/GPS switch. Manual selection of the desired track on the pilot's HSI course pointer is required to provide course datum to the autopilot. (Frequent manual course pointer changes may be necessary, such as in the case of flying a DME arc.) The autopilot approach mode (APR) should be used when conducting a coupled GPS approach.

NOTE

NAV or APR coupled DME arc intercepts can result in excessive overshoots (aggravated by high ground speeds and/or intercepts from inside the arc).

E. ALTITUDE ALERT AURAL TONES

- 1000 feet prior to reaching the selected altitude - three short tones.
- Upon reaching the selected altitude - two short tones.
- Deviating above or below the selected altitude by more than the warn altitude - four short tones.

F. APPROACH MODE SEQUENCING AND RAIM PREDICTION

NOTE

The special use airspace alert will automatically be disabled prior to flying an instrument approach to reduce the potential for message congestion.

1. Prior to arrival, select a STAR if appropriate from the APT 7 page. Select an approach and an initial approach fix (IAF) from the APT 8 page.

NOTES

- Using the outer knob, select the ACT (Active Flight Plan Waypoints) pages. Pull the inner knob out and scroll to the destination airport, then push the inner knob in and select the ACT 7 or ACT 8 page.

- To delete or replace a SID, STAR or approach, select FPL 0 page. Place the cursor over the name of the procedure, press ENT to change it, or CLR then ENT to delete it.

2. En route, check for RAIM availability at the destination airport ETA on the OTH 3 page.

NOTE

RAIM must be available at the FAF in order to fly an instrument approach. Be prepared to terminate the approach upon loss of RAIM.

3. At 30 nm from the airport:
 - a. Verify automatic annunciation of APR ARM.
 - b. Note automatic dbar scaling change from 5.0nm to 1.0 nm over the next 30 seconds.
 - c. Update the KLN 89B altimeter baro setting as required.
 - d. Internally the KLN 89B will transition from en route to terminal integrity monitoring.
4. Select NAV 4 page to fly the approach procedure.
 - a. If receiving radar vectors, or need to fly a procedure turn or holding pattern, fly in OBS until inbound to the FAF.

NOTE

OBS navigation is TO-FROM (like a VOR) without waypoint sequencing.

WARNING

To prevent the possibility of turn anticipation causing potentially misleading navigation when the aircraft is not on course, do not switch from OBS to LEG with greater than 1 nm cross track error (XTK).

- b. NoPT routes including DME arc's are flown in LEG. LEG is mandatory from the FAF to the MAP.

SECTION IV - NORMAL PROCEDURES (con't.)

NOTE

NAV or APR coupled DME arc intercepts can result in excessive overshoots (aggravated by high ground speeds and/or intercepts from inside the arc).

WARNING

Flying final outbound from an off-airport vortac on an overlay approach; beware of the DME distance increasing on final approach, and the GPS distance-to-waypoint decreasing, and not matching the numbers on the approach plate!

5. At or before 2 nm from the FAF inbound:
 - a. Select the FAF as the active waypoint, if not accomplished already.
 - b. Select LEG operation.
6. Approaching the FAF inbound (within 2 nm.):
 - a. Verify APR ACTV.
 - b. Note automatic dbar scaling change from 1.0 nm to 0.3 nm over the 2 nm inbound to the FAF.
 - c. Internally the KLN 89B will transition from terminal to approach integrity monitoring.
7. Crossing the FAF and APR ACTV is not annunciated:
 - a. Do not descend.
 - b. Execute the missed approach.
8. Missed Approach:
 - a. Climb
 - b. Navigate to the MAP (in APR ARM if APR ACTV is not available).

NOTE

There is no automatic LEG sequencing at the MAP.

- c. After climbing in accordance with the published missed approach procedure, press ,

---D-->

verify or change the desired holding fix and press ENT.

GENERAL NOTES

- The data base must be up to date for instrument approach operation.
- Only one approach can be in the flight plan at a time.
- Checking RAIM prediction for your approach while en route using the OTH 3 page is recommended. A self check occurs automatically within 2nm of the FAF. APR ACTV is inhibited without RAIM.
- Data cannot be altered, added to or deleted from the approach procedures contained in the data base. (DME arc intercepts may be relocated along the arc through the NAV 4 or the FPL 0 pages).
- Some approach waypoints do not appear on the approach plates (including in some instances the FAF)!
- Waypoint suffixes in the flight plan:
 - i - IAF
 - f - FAF
 - m - MAP
 - h - missed approach holding fix.

SECTION IV - NORMAL PROCEDURES (con't.)

The DME arc IAF (arc intercept waypoint) will be a) on your present position radial off the arc VOR when you load the IAF into the flight plan, or b) the beginning of the arc if currently on a radial beyond the arc limit. To adjust the arc intercept to be compatible with a current radar vector, bring up the arc IAF waypoint in the NAV 4 page scanning field or under the cursor on the FPL 0 page, press CLR, then ENT. Fly the arc in LEG. adjust the HSI or CDI course pointer with reference to the desired track value on the NAV 4 page (it will flash to remind you). Left/right dbar information is relative to the arc. Displayed distance is not along the arc but direct to the active waypoint. (The ARC radial is also displayed in the lower right corner of the NAV 4 page.)

The DME arc IAF identifier may be unfamiliar. Example: D098G where 098 stands for the 098 radial off the referenced VOR, and G is the seventh letter in the alphabet indicating a 7 DME arc.

- APR ARM to APR ACTV is automatic provided:
 - a. You are in APR ARM (normally automatic).
 - b. You are in LEG mode!
 - c. The FAF is the active waypoint!
 - d. Within 2 n.m. of the FAF.
 - e. Outside of the FAF.
 - f. Inbound to the FAF.
 - g. RAIM is available.
- Direct-To operation between the FAF and MAP cancels APR ACTV. Fly the missed approach in APR ARM.
- Flagged navigation inside the FAF may usually be restored (not guaranteed) by pressing the GPS APR button changing from ACTV to ARM. Fly the missed approach.
- The instrument approach using the KLN 89B may be essentially automatic starting 30 nm out (with a manual baro setting update) or it may require judicious selection of the OBS and LEG modes.
- APR ARM may be canceled at any time by pressing the GPS APR button. (A subsequent press will reselect it.)

SECTION V THRU X

No changes.

